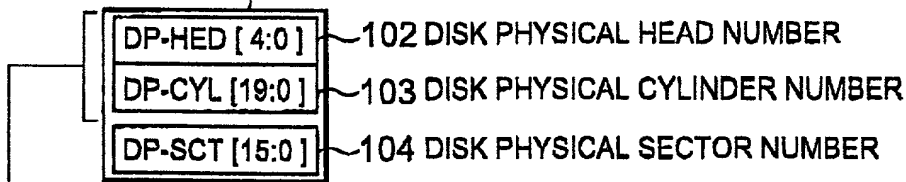


FIG.1

METHOD OF ACCESSING DEFECT INFORMATION

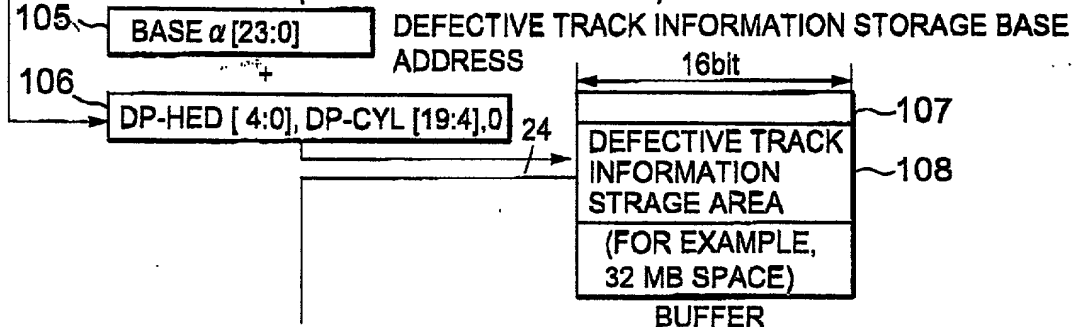
(STEP 1) MPU DESIGNATES A TARGET ADDRESS TO DF.

101 DISK PHYSICAL CHS NUMBER

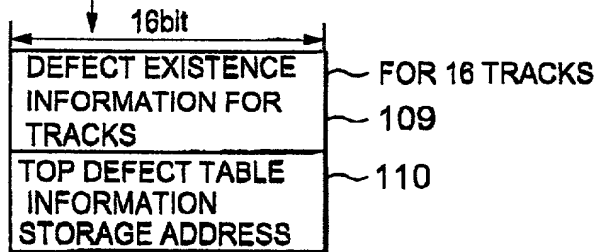


(STEP 2) DM USES THIS TARGET ADDRESS TO LOAD THE DEFECT INFORMATION ON THE TRACK IN QUESTION
DM USES THIS NUMBER TO LOAD THE DEFECT INFORMATION FROM THE DEFECT STORAGE

ADDRESS (ADDRESS SHOWN BELOW) IN THE BUFFER.



(STEP 3) TOP STORAGE ADDRESS AT WHICH A DEFECT EXISTS IS OBTAINED FROM THE DEFECT INFORMATION LOADED.



(STEP 4) TOP STORAGE ADDRESS AT WHICH DEFECT TABLE INFORMATION EXISTS IS OBTAINED FROM THE DEFECT INFORMATION LOADED.

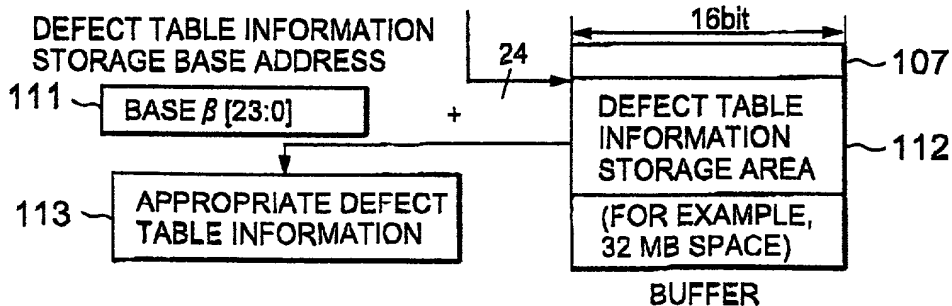


FIG.2

FORMAT OF DEFECTIVE TRACK INFORMATION STORAGE AREA (TYPE 1)

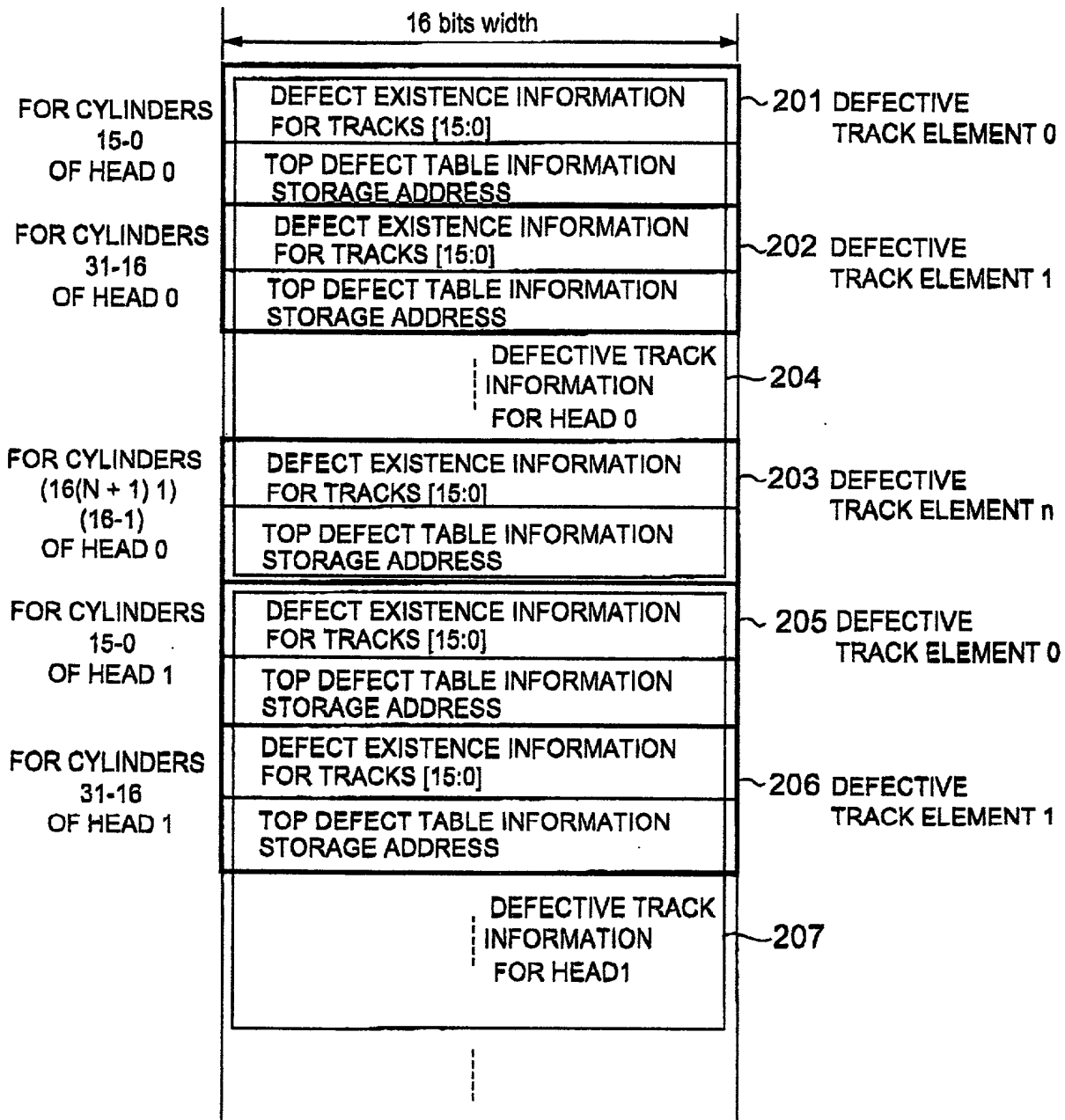


FIG.3

EXAMPLE OF FORMAT OF DEFECTIVE ELEMENT INFORMATION
FOR TRACKS (TYPE 1)

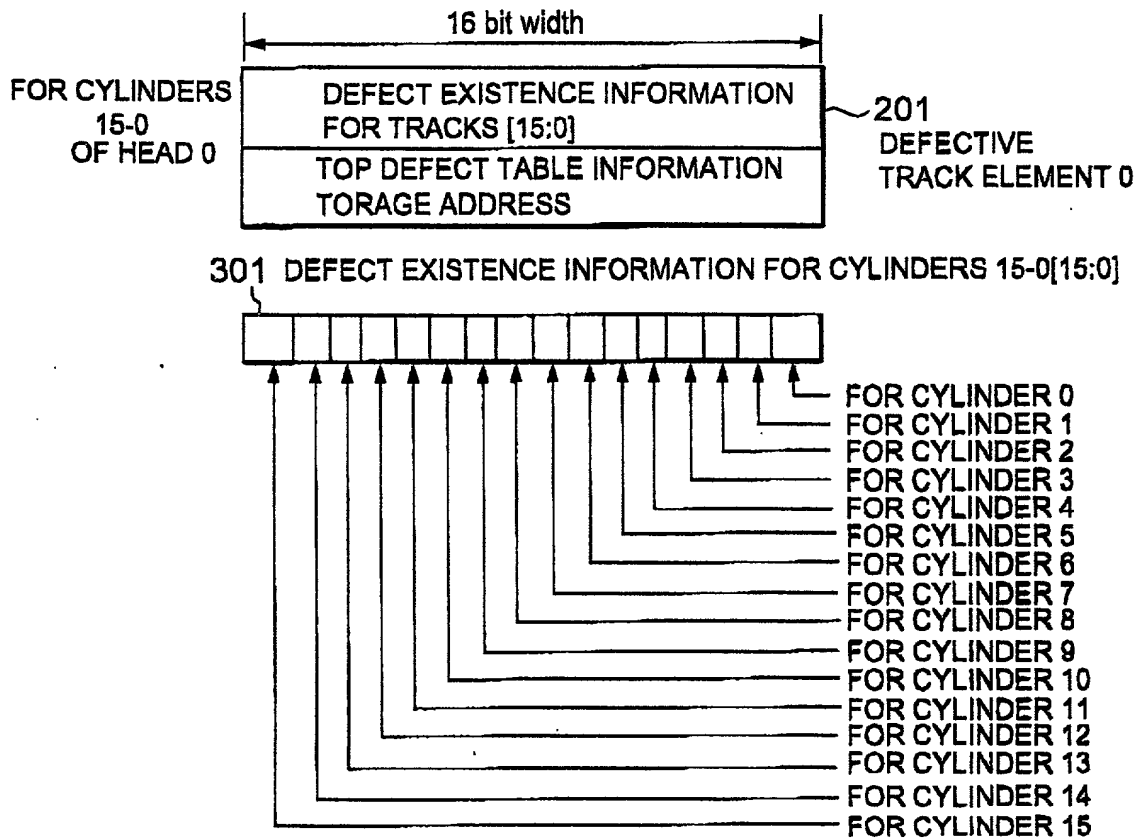


FIG.4

EXAMPLE OF FORMAT OF DEFECTIVE TABLE INFORMATION
STORAGE ADDRESS (TYPE 1)

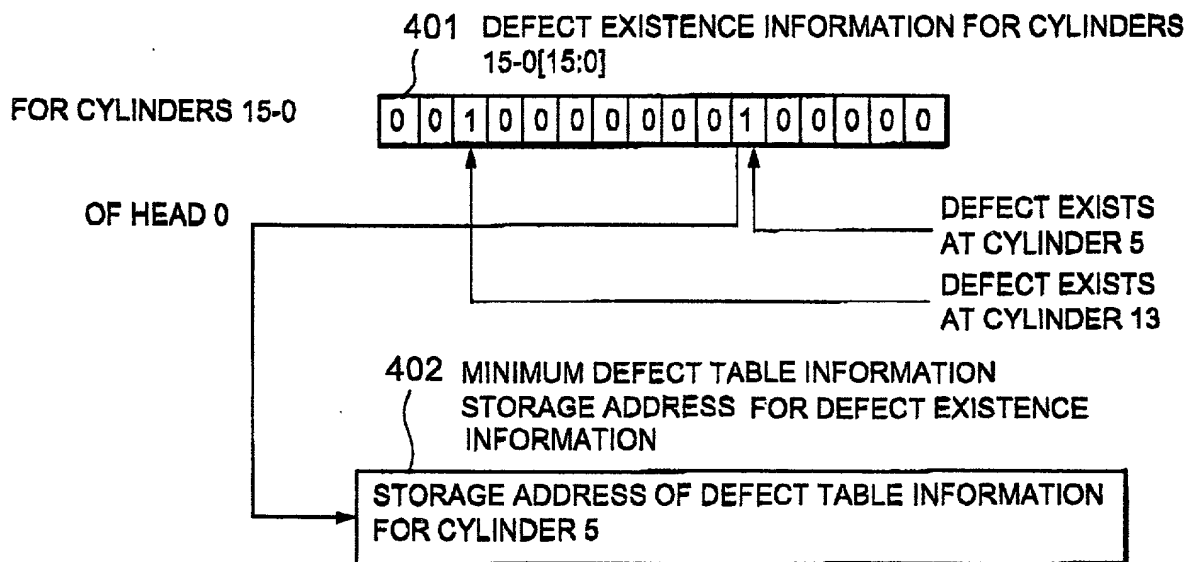
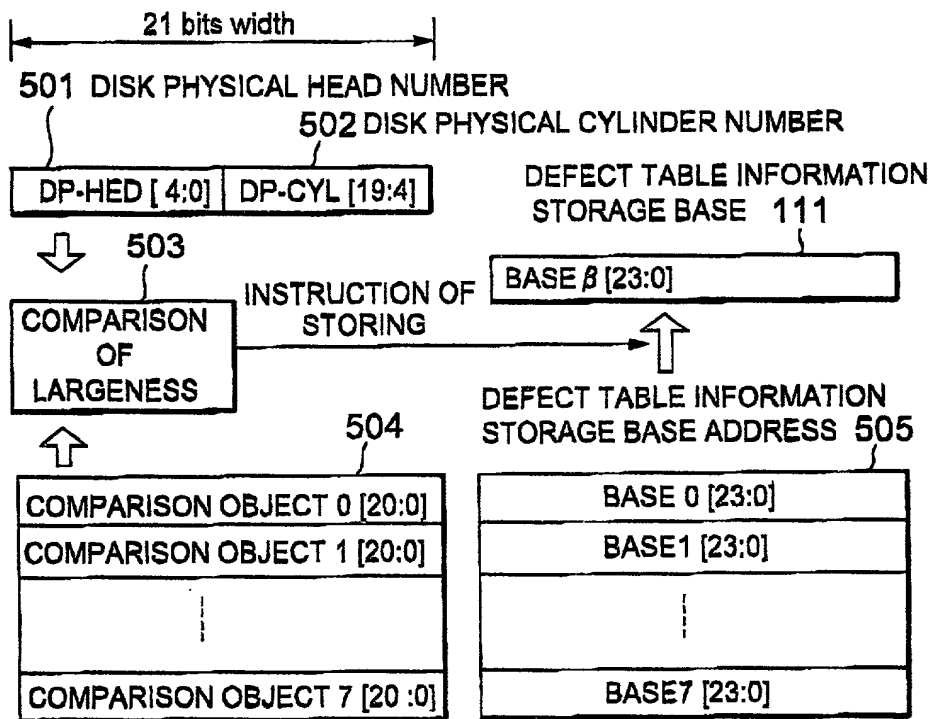


FIG.5

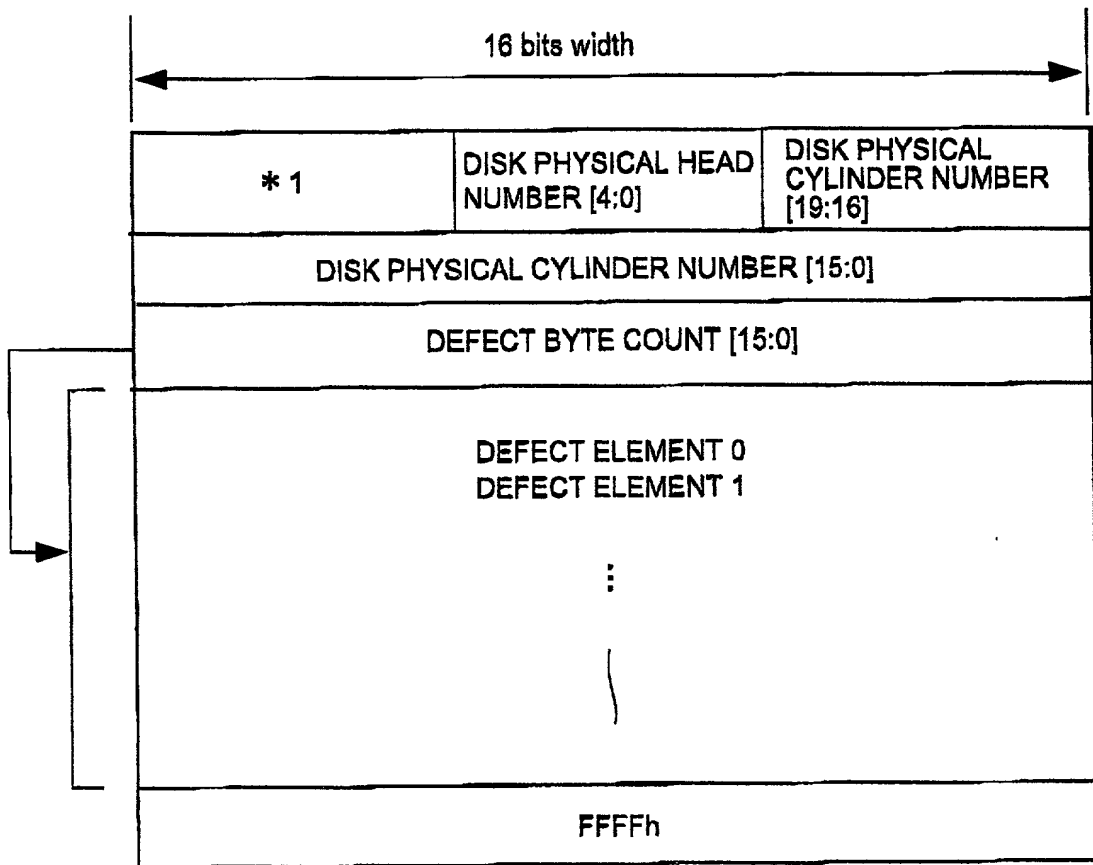
SELECTION OF ADDRESS BASE FOR THE DEFECT TABLE INFORMATION STORAGE AREA



10006669 121001

FIG.6

FORMAT OF DEFECT TABLE INFORMATION STORAGE AREA (TYPE 1)



(* 1) 7bit RESERVED

601 DEFECT TABLE FORMAT

FIG.7

SECTOR ALLOCATION MAP INCLUDING DEFECTS

(IN THE CASE OF HEAD = 0,
TRACK m MEANS
CYLINDER NUMBER = m
AND HEAD NUMBER = 0)

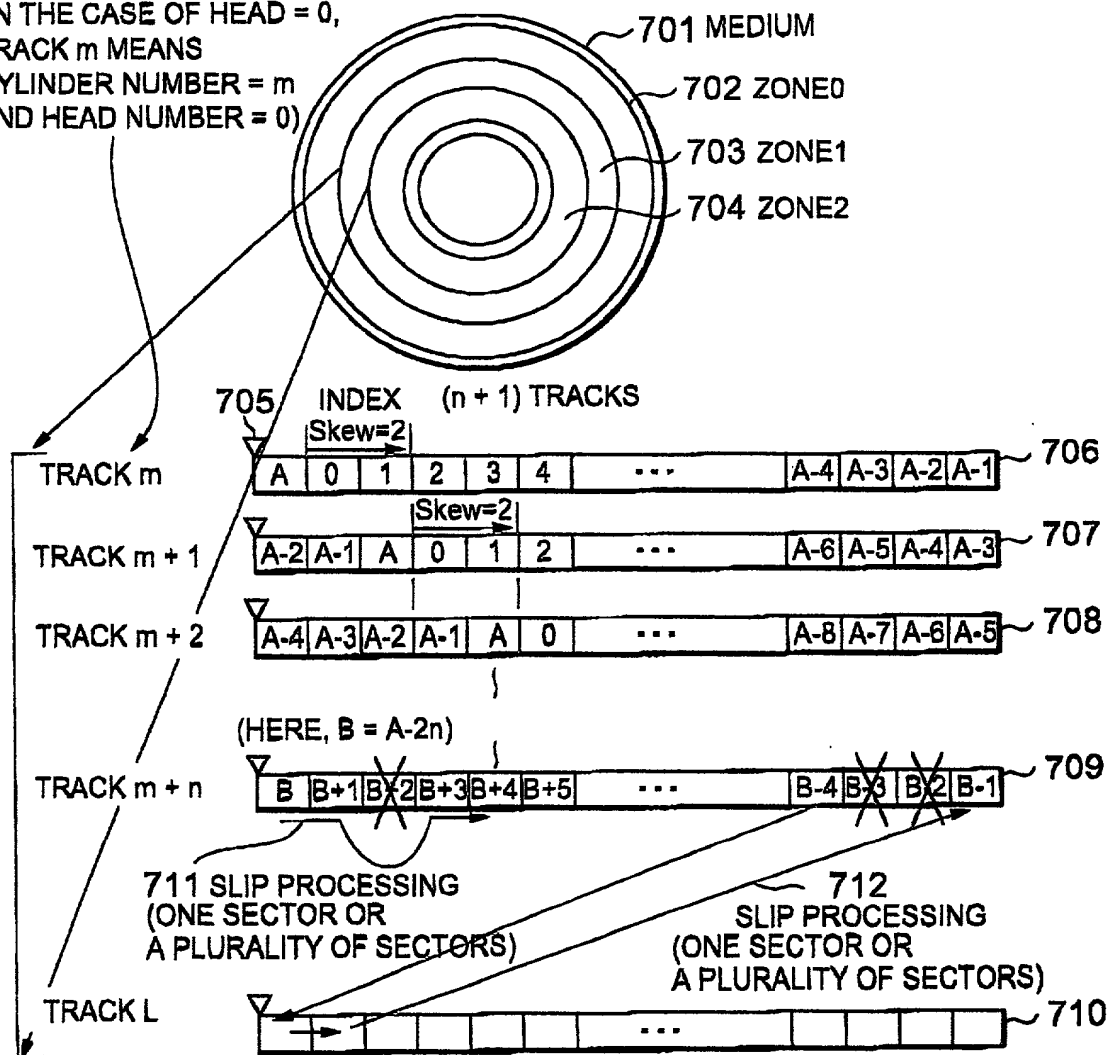


FIG.8

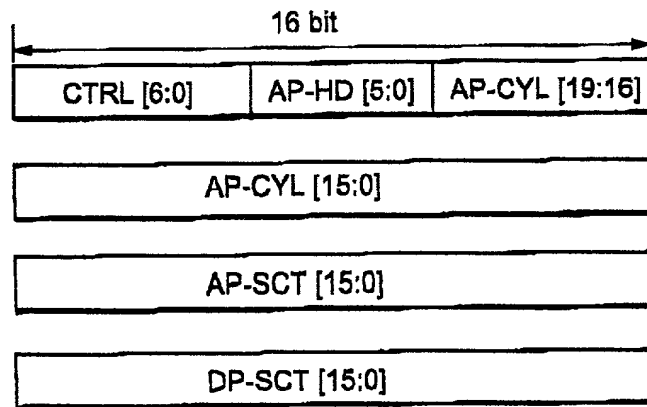
INFORMATION REQUIRED FOR A DEFECT ELEMENT

KIND OF DEFECT INFORMATION	CONTENTS
(1) SKIP INFORMATION	1) DISK PHYSICAL SECTOR NUMBER (DP-SCT [19:0]) AT WHICH A DEFECT EXISTS. 2) DISK PHYSICAL SECTOR NUMBER OF SUBSTITUTE (AP-CYL [19:0], AP- HED[4:0], AP-SCT [15:0]) 3) THE NUMBER OF SECTORS TO BE SKIPPED SUCCESSIVELY (DP-SCTCNT[15:0])
(2) SLIP INFORMATION	1) DISK PHYSICAL NUMBER (DP-SCT[15:0] AT WHICH A DEFECT EXISTS. : 2) THE NUMBER OF SECTORS TO BE SLIPPED SUCCESSIVELY (ADP- SECNUM[15:0])
(3) END SECTOR INFORMATION	1) END SECTOR NUMBER (DP-SCT[15:0]) OF THE TRACK CONCERNED WHEN THE END SECTOR IS UNUSABLE AS A DEFECTIVE SECTOR, THE USABLE END DISK PHYSICAL SECTOR NUMBER IN THE TRACK IS DESIGNATED

FIG.9

FORMAT OF DEFECT ELEMENT (FIRST)

(1) SKIP OF ONE SECTOR (4 W)



(2) SKIP OF SUCCESSIVE SECTORS (5 W)

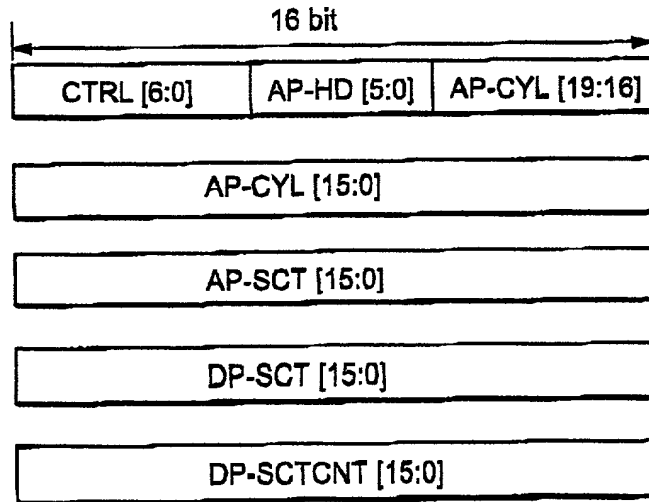
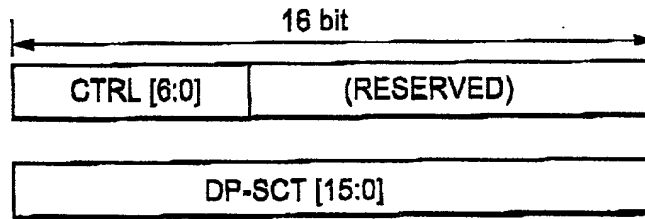


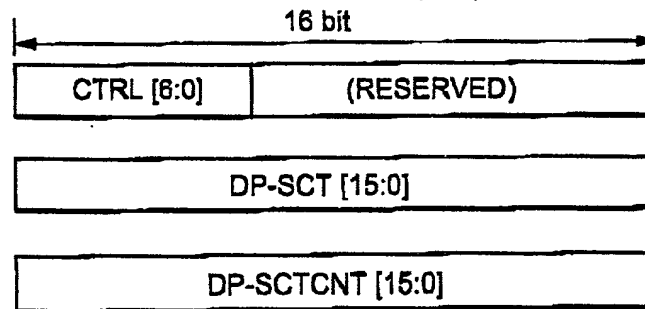
FIG.10

FORMAT OF DEFECT ELEMENT (SECOND)

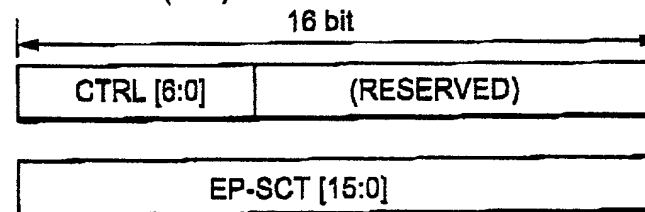
(3) SLIP OF ONE SECTOR (2 W)



(4) SLIP OF SUCCESSIVE SECTORS (3 W)



(5) END SECTOR (2 W)



(6) BOUNDARY OF THE DEFECT TABLE (1 W)

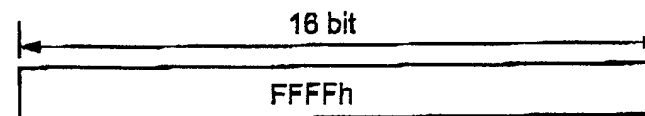
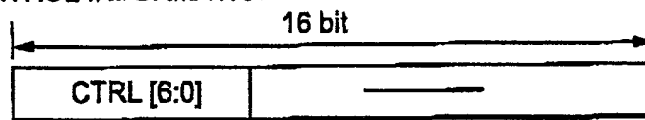


FIG.11

FORMAT OF CONTROL INFORMATION

(1) CONTROL INFORMATION



1101

CTRL [6] : END OF SECTOR

1: END SECTOR NUMBER OF THE TRACK

CTRL [5] : SKIP/SLIP

INDICATION OF SKIP OR SLIP

1: SKIP, 0: SLIP

CTRL [4] : SEQUENTIAL

INDICATION OF SUCCESSIVE SECTORS PROCESSING

1: SUCCESSIVE SECTOR PROCESSING, 0: ONE SECTOR PROCESSING

CTRL [3] : SPARE ON TRACK

INDICATION IF A SUBSTITUTE OF THE DEFECTIVE SECTOR EXISTS
ON THE CURRENT TRACK

1: CURRENT TRACK, 0: ANOTHER TRACK

CTRL [2] : (RESERVED)

CTRL [1] : (RESERVED)

CTRL [0] : (RESERVED)

FIG.13

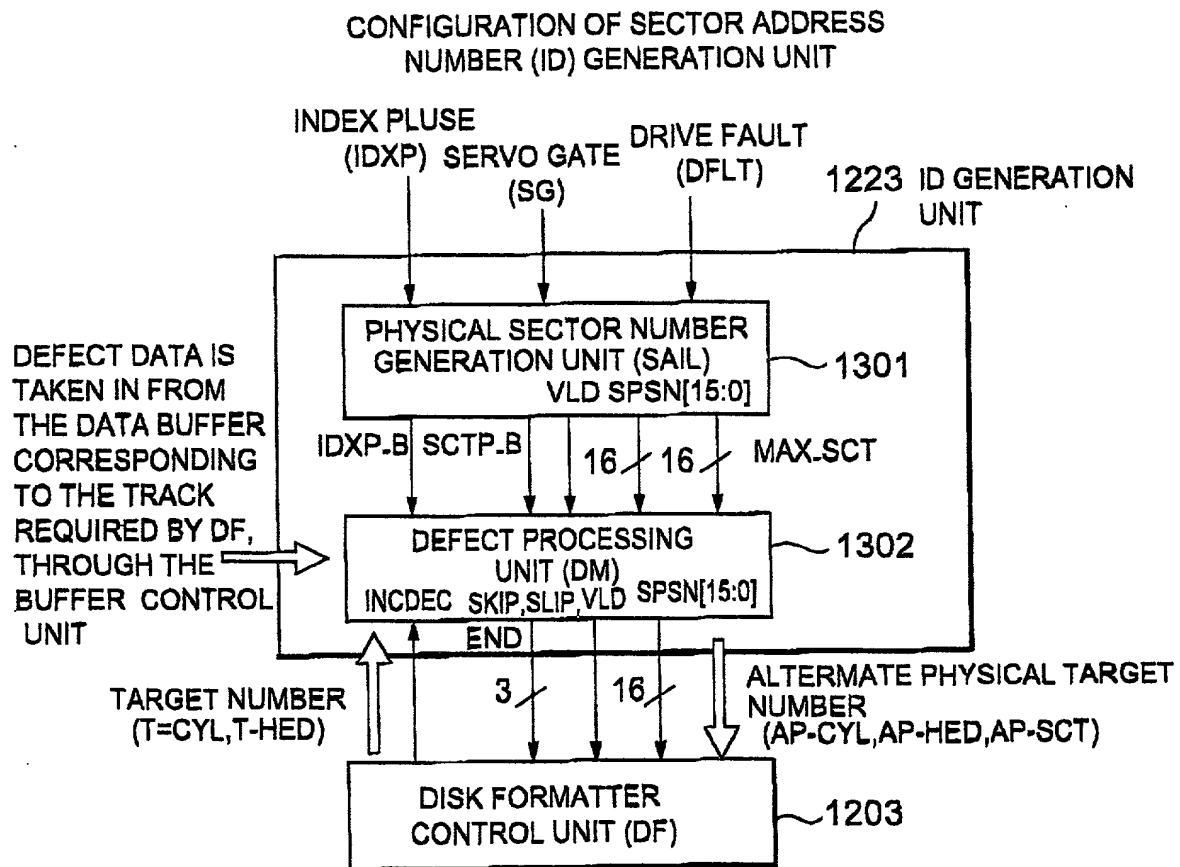
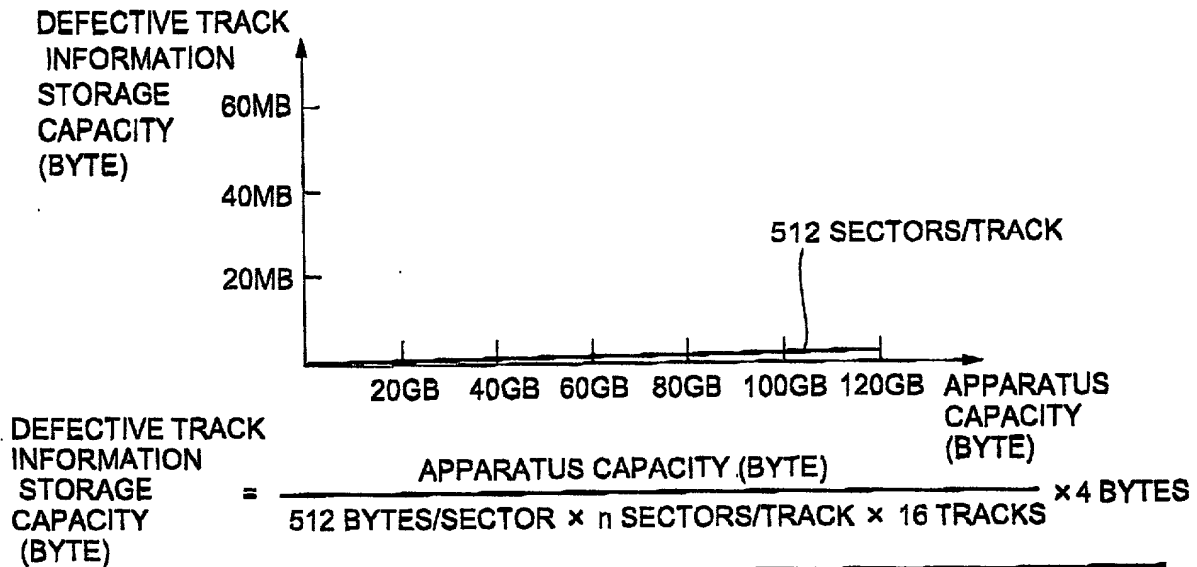


FIG.14

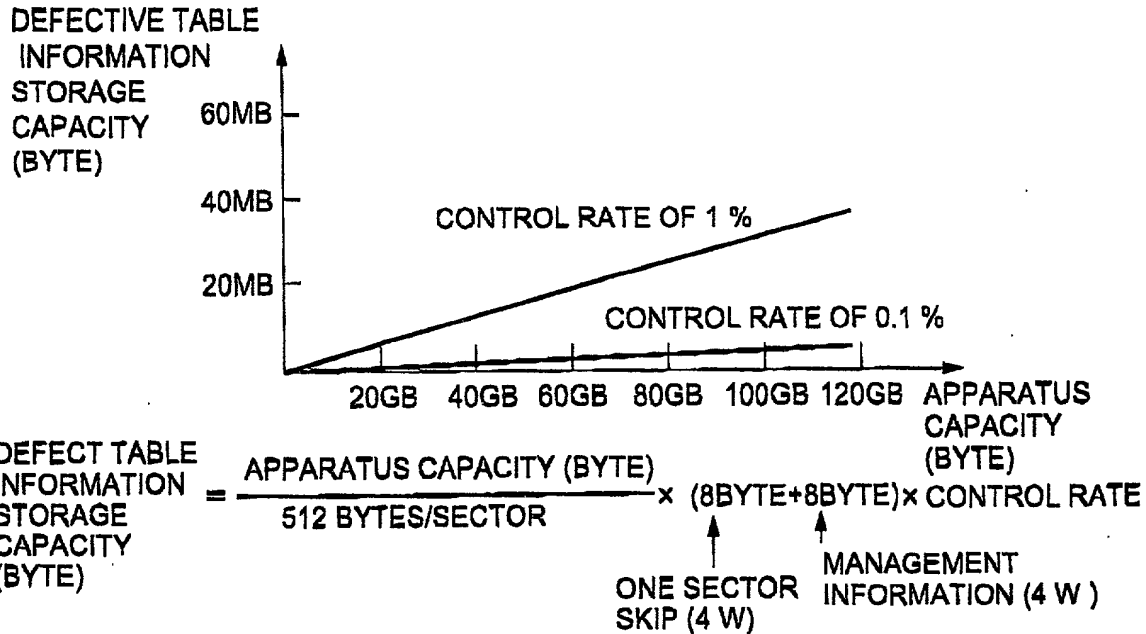
APPARATUS CAPACITY AND TRACK INFORMATION
STORAGE CAPACITY(TYPE 1)



APPARATUS CAPACITY	TOTAL SECTOR COUNT	DEFECTIVE TRACK INFORMATION STORAGE CAPACITY			
		SECTOR COUNT PER TRACK (n: SECTORS/TRK)			
		512	1024	2048	4096
20GB	39MSECTORS	19.1KB	9.5KB	4.8KB	2.4KB
40GB	78MSECTORS	38.1KB	19.1KB	9.5KB	4.8KB
60GB	117MSECTORS	57.2KB	28.6KB	14.3KB	7.2KB
80GB	156MSECTORS	76.3KB	38.1KB	19.1KB	9.5KB
100GB	195MSECTORS	95.4KB	47.7KB	23.8KB	11.9KB
120GB	234MSECTORS	114KB	57.2KB	28.6KB	14.3KB

FIG.15

APPARATUS CAPACITY AND DEFECT TABLE
INFORMATION STORAGE CAPACITY (TYPE1)



CONTROL RATE = CONTROLLED NUMBER OF DEFECTIVE SECTORS / NUMBER OF ALL SECTORS IN APPARATUS

(a) CONTROL RATE OF 0.1 %

APPARATUS CAPACITY	TOTAL SECTOR COUNT	DEFECT TABLE INFORMATION STORAGE CAPACITY
20GB	39MSECTORS	39 K DEFECTIVE SECTORS (625 KB)
40GB	78MSECTORS	78 K DEFECTIVE SECTORS (1.3MB)
60GB	117MSECTORS	117K DEFECTIVE SECTORS (1.9MB)
80GB	156MSECTORS	156K DEFECTIVE SECTORS (2.5MB)
100GB	195MSECTORS	195K DEFECTIVE SECTORS (3.1MB)
120GB	234MSECTORS	234K DEFECTIVE SECTORS (3.8MB)

(b) CONTROL RATE OF 1%

APPARATUS CAPACITY	TOTAL SECTOR COUNT	DEFECT TABLE INFORMATION STORAGE CAPACITY
20GB	39MSECTORS	390 K DEFECTIVE SECTORS (6.3MB)
40GB	78MSECTORS	780 K DEFECTIVE SECTORS (13MB)
60GB	117MSECTORS	1.2M DEFECTIVE SECTORS (19MB)
80GB	156MSECTORS	1.6M DEFECTIVE SECTORS (25MB)
100GB	195MSECTORS	2.0M DEFECTIVE SECTORS (31MB)
120GB	234MSECTORS	2.3M DEFECTIVE SECTORS (38MB)

FIG.16

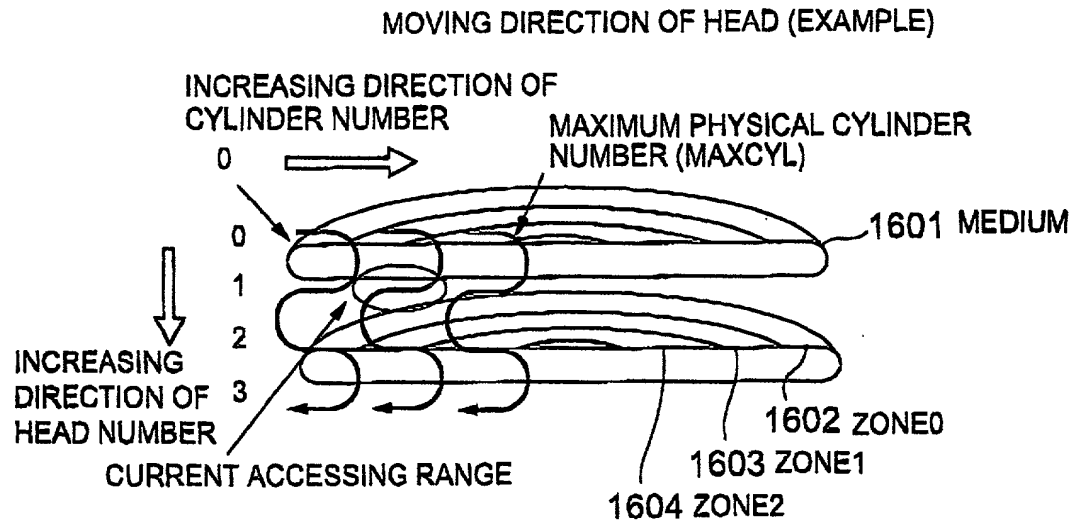


FIG.17

RELATION BETWEEN MOVING DIRECTION OF HEAD, CYLINDER AND HEAD (EXAMPLE)

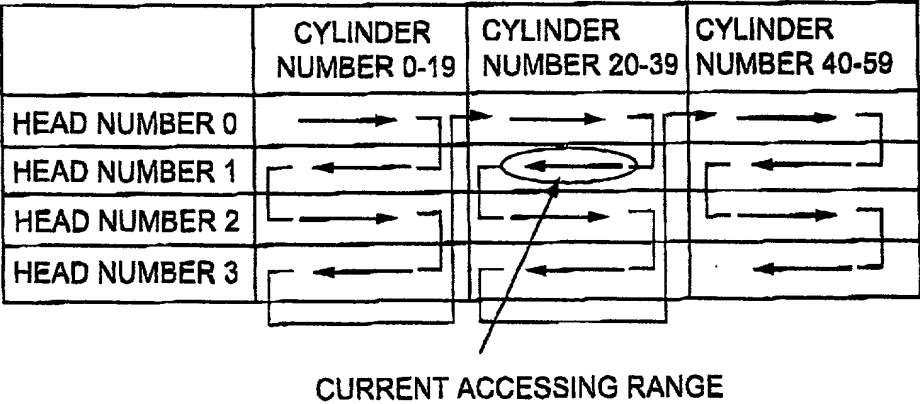
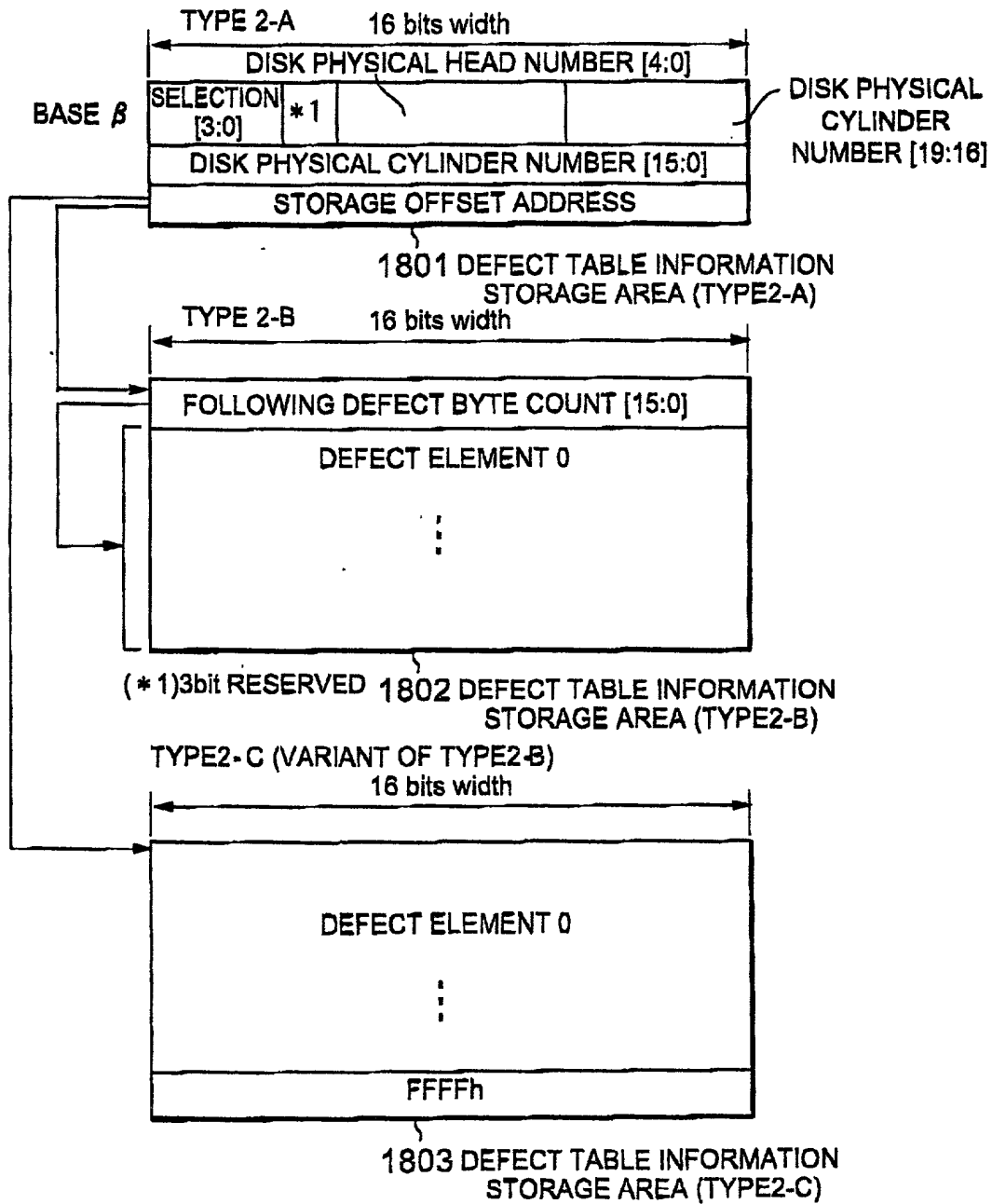


FIG.18

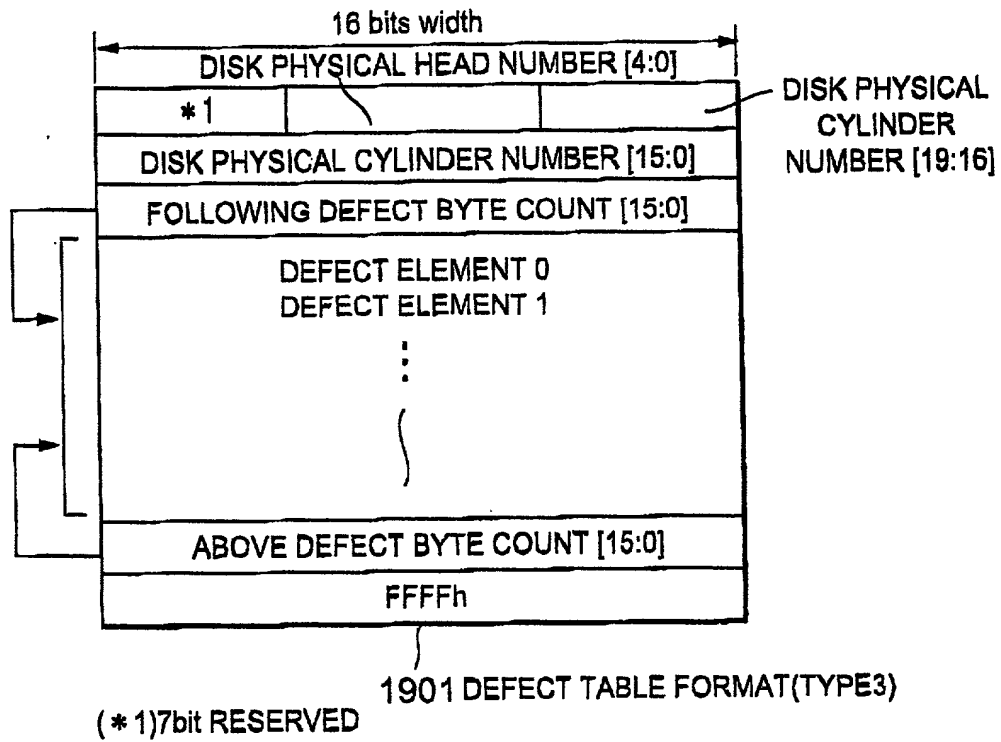
FORMAT OF DEFECT TABLE INFORMATION
STORAGE AREA (TYPE2)



total 69900F

FIG.19

FORMAT OF DEFECT TABLE INFORMATION
STORAGE AREA (TYPE3)



1000569-12001
TOTAL 699002

FIG.20

COMPARISON OBJECT 504

DEFECT TABLE BASE
ADDRESS 505

TRACK NUMBER 0-100	1000H
TRACK NUMBER 101-500	5000H
TRACK NUMBER 501-800	8000H
...	...

100666 100666 100666

FIG.21

FORMAT OF DEFECT TABLE INFORMATION STORAGE AREA (TYPE2-A)

(FOR DISK PHYSICAL HEADS 0-3)

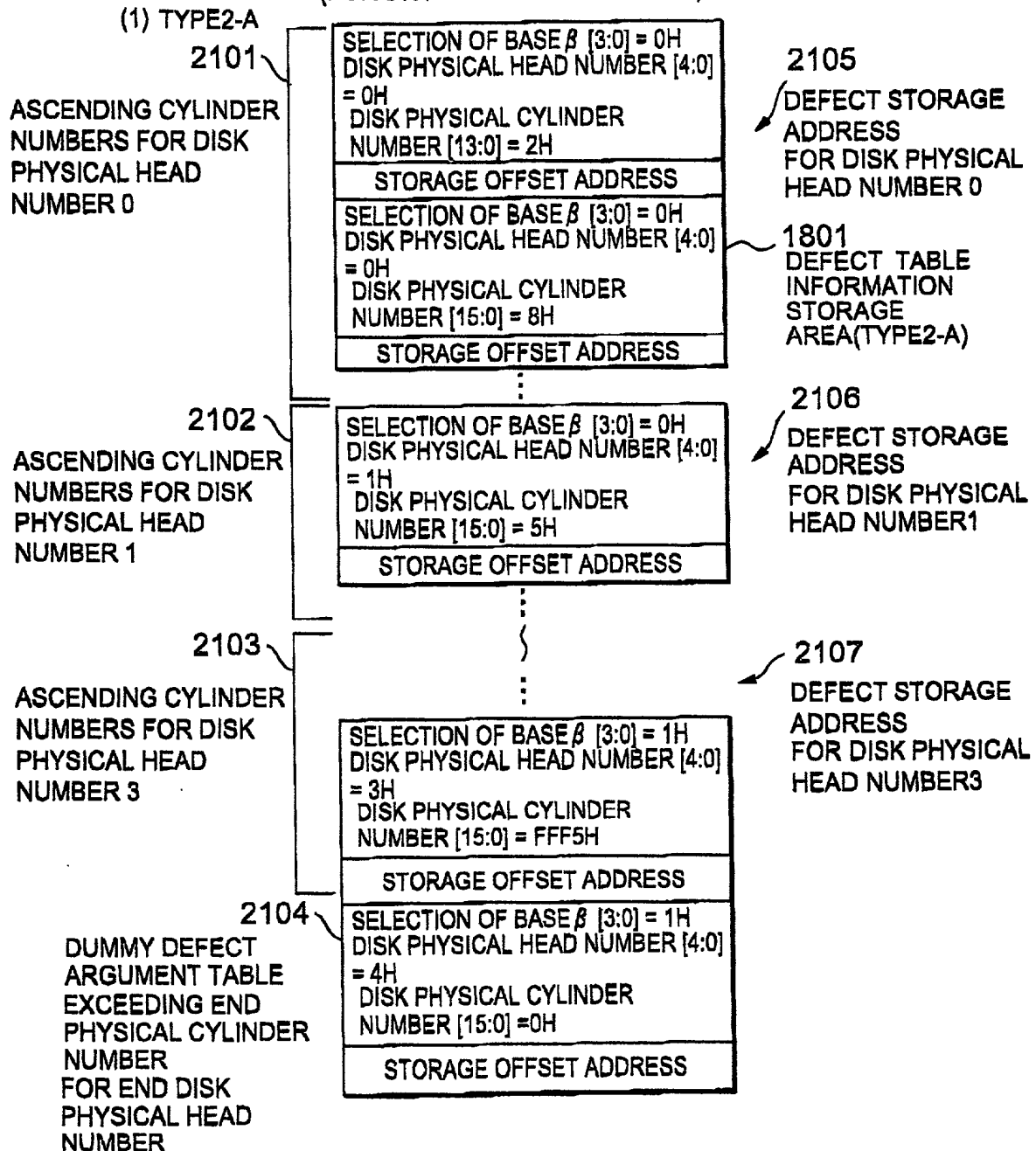


FIG.22

FORMAT OF DEFECT TABLE INFORMATION STORAGE AREA (TYPE2-B)
(FOR DISK PHYSICAL HEADS 0-3)

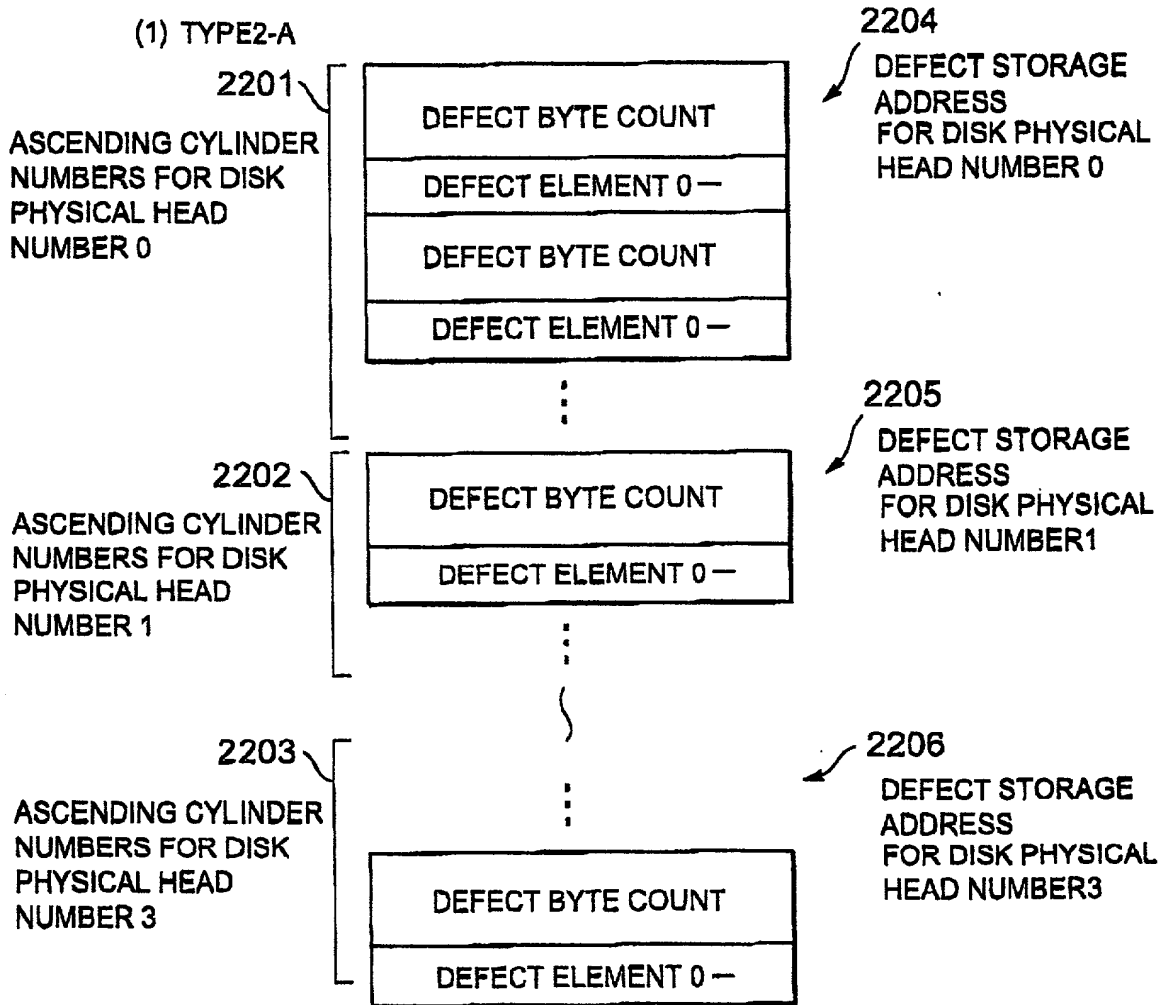


FIG.23

FORMAT OF DEFECT TABLE INFORMATION STORAGE AREA (TYPE3)

(FOR DISK PHYSICAL HEADS 0-3

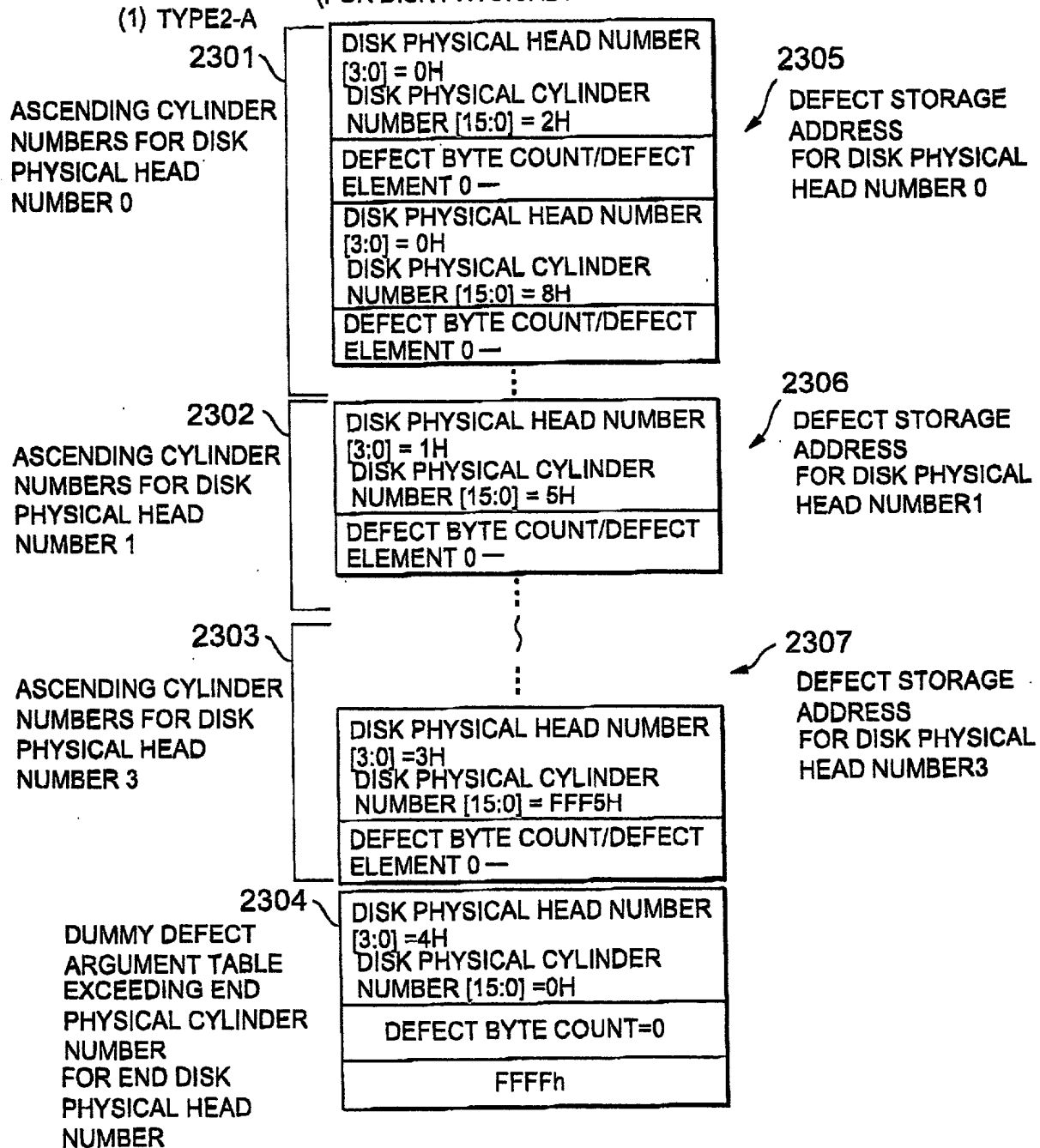


FIG.24

APPARATUS CAPACITY AND DEFECT TABLE INFORMATION STORAGE CAPACITY (TYPE2)

DEFECT TABLE
INFORMATION
STORAGE
CAPACITY
(BYTE)

60MB

40MB

20MB

CONTROL RATE OF 1 %

CONTROL RATE OF 0.1 %

20GB 40GB 60GB 80GB 100GB 120GB

APPARATUS

CAPACITY

(BYTE)

DEFECT TABLE
INFORMATION
STORAGE
CAPACITY
(BYTE)

APPARATUS CAPACITY (BYTE)

$$= \frac{\text{APPARATUS CAPACITY (BYTE)}}{512 \text{ BYTES/SECTOR}}$$

$$\times (10 \text{ BYTE} + 6 \text{ BYTE}) \times \text{CONTROL RATE}$$

MANAGEMENT
INFORMATION (3 W):TYPE2A

ONE SECTOR SKIP (4 W) +(1w):TYPE2B,OR 2C

CONTROL RATE = CONTROLLED NUMBER OF DEFECTIVE SECTORS / NUMBER
OF ALL SECTORS IN APPARATUS

(a) CONTROL RATE OF 0.1 %

APPARATUS CAPACITY	TOTAL SECTOR COUNT	DEFECT TABLE INFORMATION STORAGE CAPACITY
20GB	39M SECTORS	39 K DEFECTIVE SECTORS (625KB)
40GB	78M SECTORS	78 K DEFECTIVE SECTORS (1.3MB)
60GB	117M SECTORS	117K DEFECTIVE SECTORS (1.9MB)
80GB	156M SECTORS	156K DEFECTIVE SECTORS (2.5MB)
100GB	195M SECTORS	195K DEFECTIVE SECTORS (3.1MB)
120GB	234M SECTORS	234K DEFECTIVE SECTORS (3.8MB)

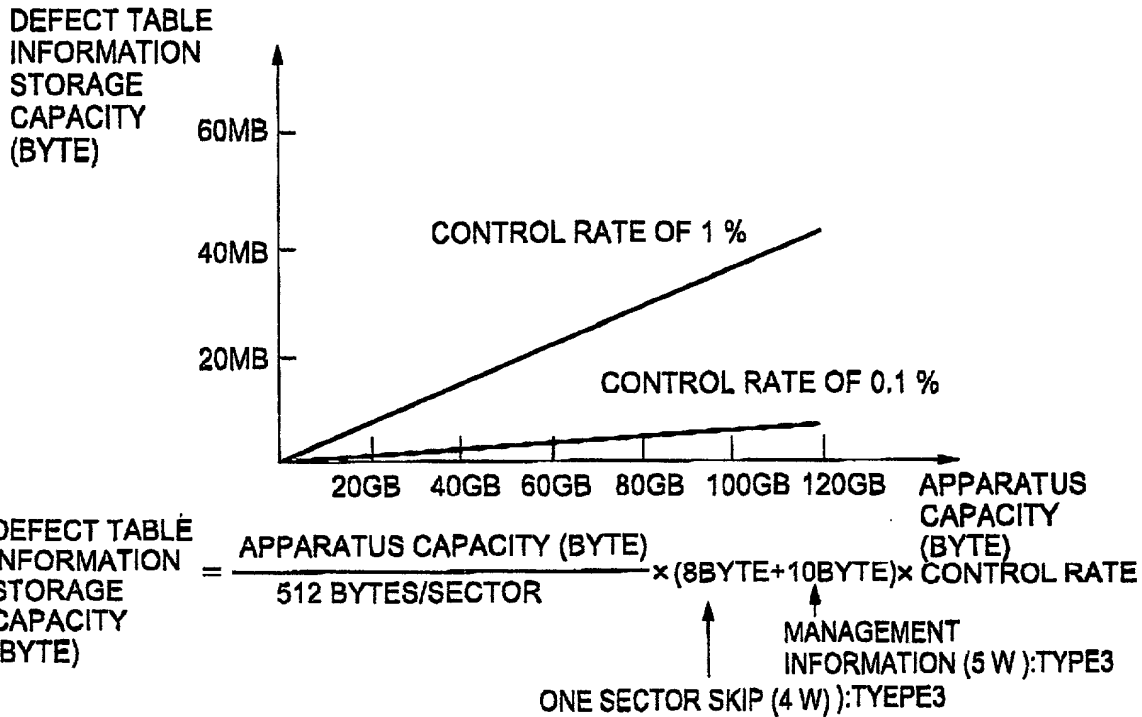
(b) CONTROL RATE OF 1%

APPARATUS CAPACITY	TOTAL SECTOR COUNT	DEFECT TABLE INFORMATION STORAGE CAPACITY
20GB	39M SECTORS	390 K DEFECTIVE SECTORS (6.3MB)
40GB	78M SECTORS	780 K DEFECTIVE SECTORS (13MB)
60GB	117M SECTORS	1.2M DEFECTIVE SECTORS (19MB)
80GB	156M SECTORS	1.6M DEFECTIVE SECTORS (25MB)
100GB	195M SECTORS	2.0M DEFECTIVE SECTORS (31MB)
120GB	234M SECTORS	2.3M DEFECTIVE SECTORS (38MB)

10005669.12001

FIG.25

APPARATUS CAPACITY AND DEFECT TABLE INFORMATION STORAGE CAPACITY (TYPE3)



CONTROL RATE = CONTROLLED NUMBER OF DEFECTIVE SECTORS / NUMBER OF ALL SECTORS IN APPARATUS

(a) CONTROL RATE OF 0.1 %

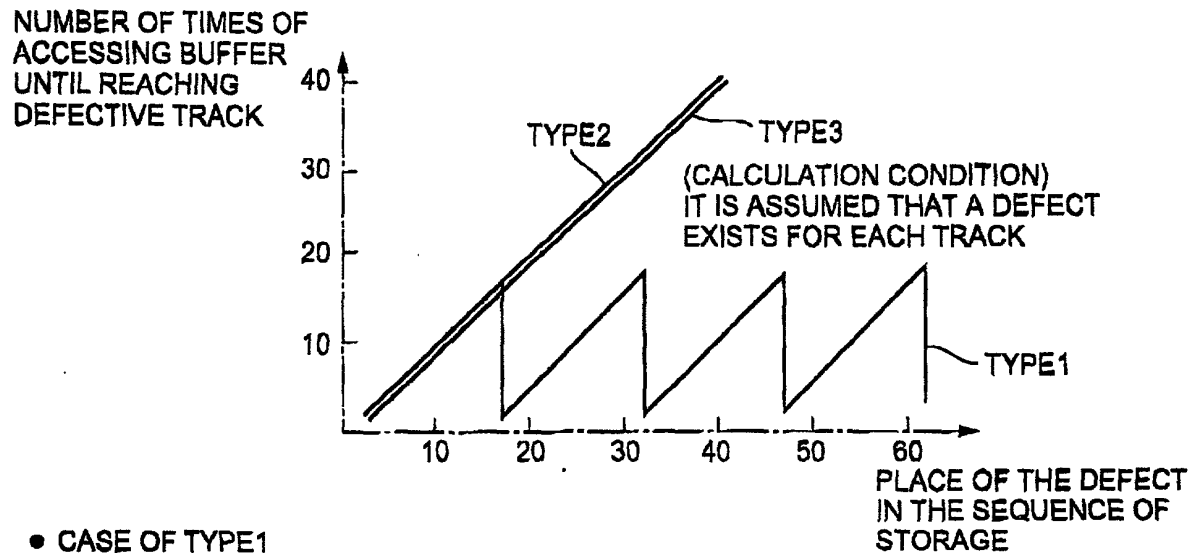
APPARATUS CAPACITY	TOTAL SECTOR COUNT	DEFECT TABLE INFORMATION STORAGE CAPACITY
20GB	39M SECTORS	39 K DEFECTIVE SECTORS (700KB)
40GB	78M SECTORS	78 K DEFECTIVE SECTORS (1.4MB)
60GB	117M SECTORS	117K DEFECTIVE SECTORS (2.1MB)
80GB	156M SECTORS	156K DEFECTIVE SECTORS (2.8MB)
100GB	195M SECTORS	195K DEFECTIVE SECTORS (3.5MB)
120GB	234M SECTORS	234K DEFECTIVE SECTORS (4.2MB)

(b) CONTROL RATE OF 1%

APPARATUS CAPACITY	TOTAL SECTOR COUNT	DEFECT TABLE INFORMATION STORAGE CAPACITY
20GB	39M SECTORS	390 K DEFECTIVE SECTORS (7MB)
40GB	78M SECTORS	780 K DEFECTIVE SECTORS (14MB)
60GB	117M SECTORS	1.2M DEFECTIVE SECTORS (21MB)
80GB	156M SECTORS	1.6M DEFECTIVE SECTORS (28MB)
100GB	195M SECTORS	2.0M DEFECTIVE SECTORS (35MB)
120GB	234M SECTORS	2.3M DEFECTIVE SECTORS (42MB)

FIG.26

COMPARISON OF NUMBERS OF TIMES OF ACCESSING BUFFER
REQUIRED UNTIL REACHING TARGET DEFECTIVE TRACK



- CASE OF TYPE1
(PROCEDURE 1) ACCESS TO DEFECTIVE TRACK INFORMATION STORAGE AREA
(PROCEDURE 2) ACCESS TO TOP OF DEFECT TABLE INFORMATION STORAGE AREA
(PROCEDURE 3) ACCESS TO DEFECT TABLE INFORMATION STORAGE AREA
(2ND THROUGH 16TH AT MAXIMUM; IN THE SEQUENCE OF STORAGE)
- CASE OF TYPE2
(PROCEDURE 1) ACCESS TO DEFECTIVE TRACK INFORMATION STORAGE AREA
(IN ORDER OF STORAGE)
(PROCEDURE 2) ACCESS TO DEFECT TABLE INFORMATION
- CASE OF TYPE3
(PROCEDURE 1) ACCESS TO DEFECTIVE TRACK INFORMATION STORAGE AREA
(IN ORDER OF STORAGE)

TABLE DEFECTIVE TRACK STORAGE NUMBER AND THE NUMBER
OF TIMES OF ACCESSING THE BUFFER

PLACE OF THE DEFECTIVE TRACK IN THE SEQUENCE OF STORAGE	NUMBER OF TIMES OF ACCESSING THE BUFFER		
	TYPE1	TYPE2	TYPE3
1	2	2	1
2	3	3	2
3	4	4	3
...			
16	17	17	16
17	2	18	17
18	3	19	18
...			
n	RESIDUE (n/16) +1	n+1	n

FIG.27

METHOD OF GENERATING OFFSET ADDRESS
FOR DEFECTIVE TRACK INFORMATION (FIRST)

(STEP 1) MPU DESIGNATES A TARGET ADDRESS TO DF.

101 DISK PHYSICAL CHS NUMBER

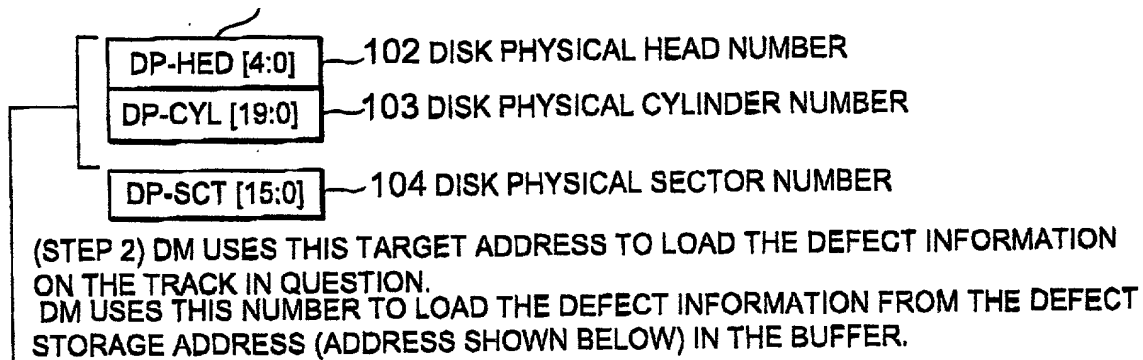


FIG.28

METHOD OF GENERATING OFFSET ADDRESS
FOR DEFECTIVE TRACK INFORMATION (SECOND)

(STEP 1) MPU DESIGNATES A TARGET ADDRESS TO DF.

101 DISK PHYSICAL CHS NUMBER

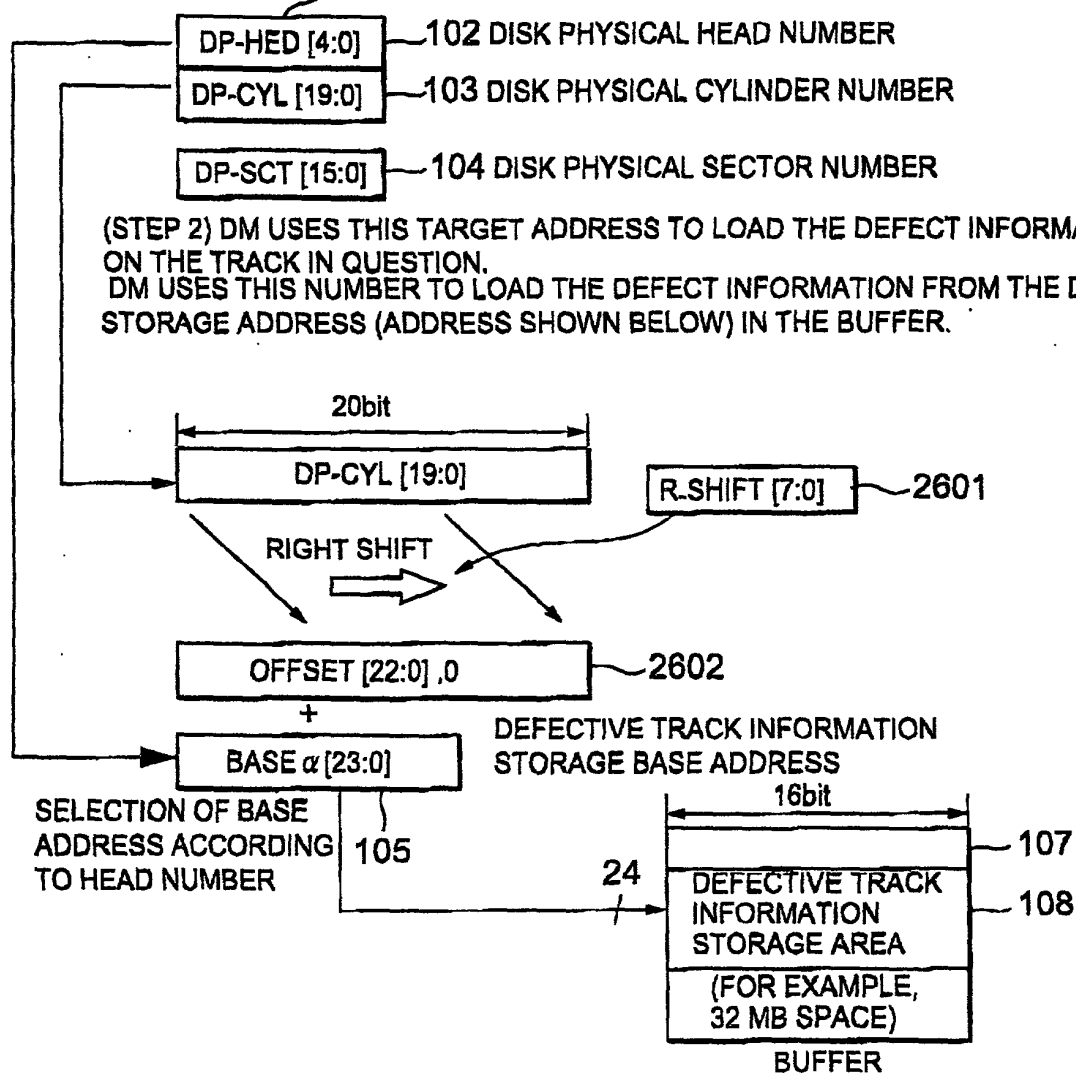


FIG.29

EXAMPLE OF FORMAT OF DEFECTIVE TRACK INFORMATION
FOR TRACKS (TYPE 4)

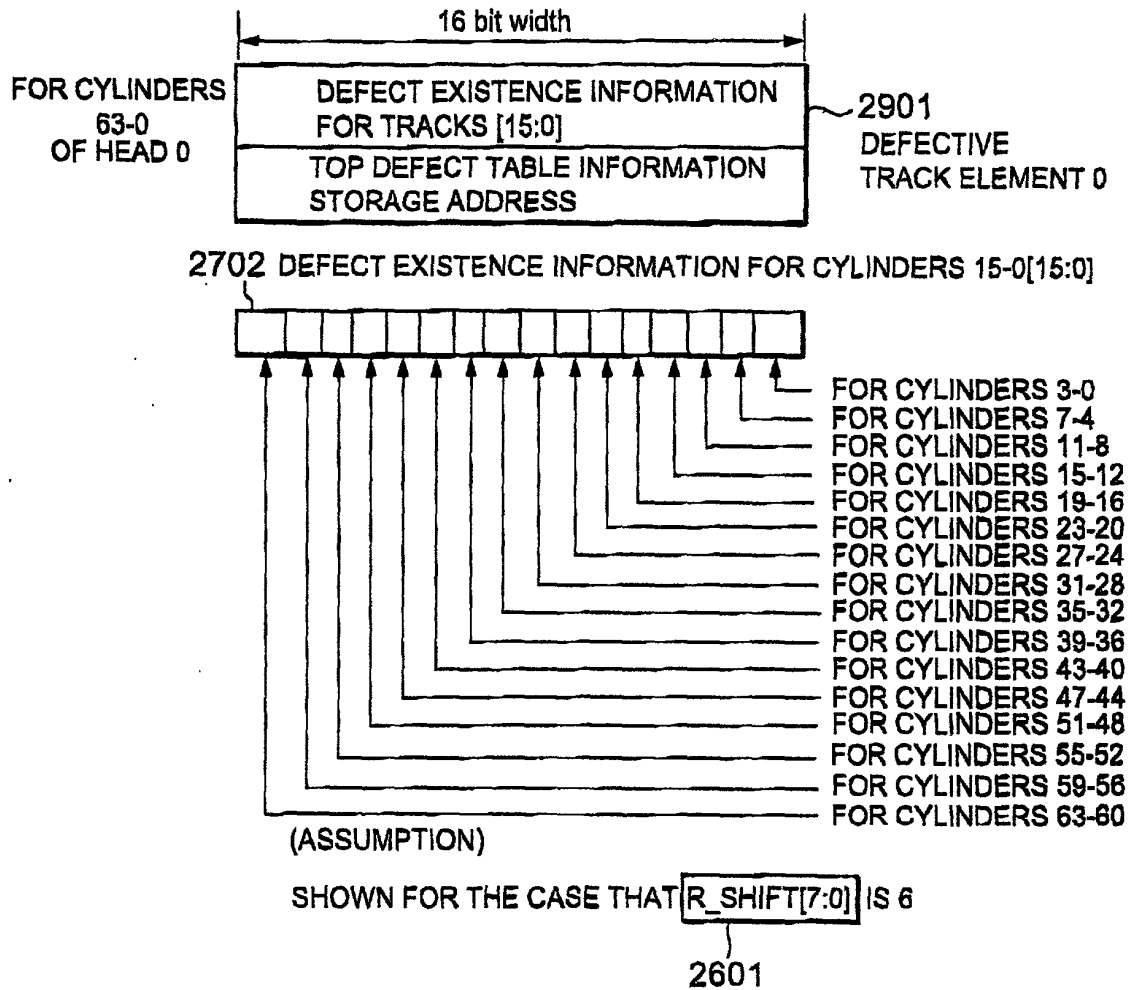
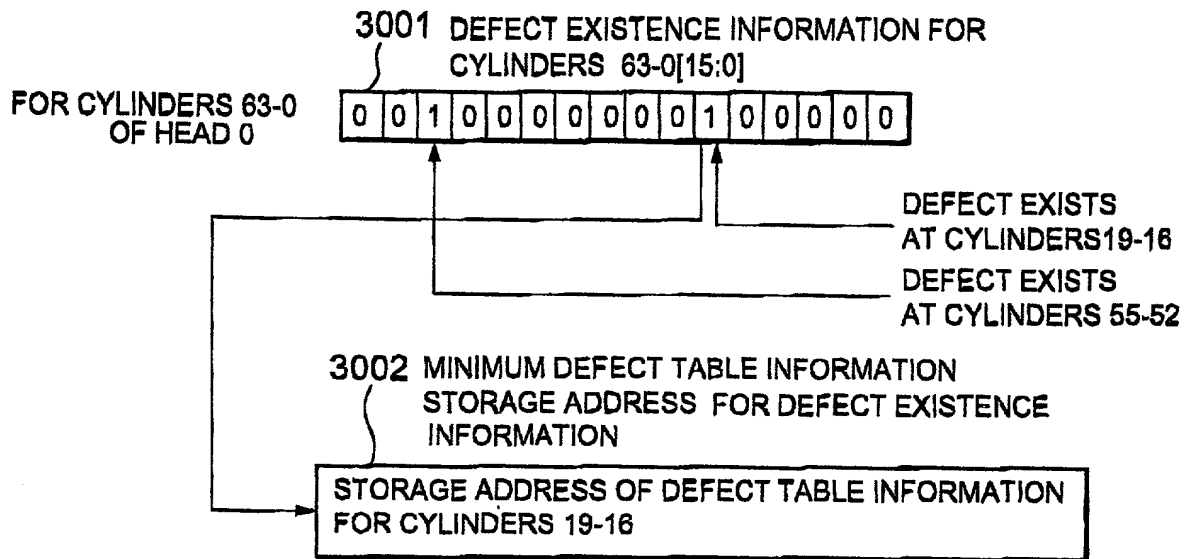


FIG.30

EXAMPLE OF FORMAT OF DEFECTIVE TRACK INFORMATION
STORAGE ADDRESS FOR TRACKS (TYPE4)



10006659-121001
TOTAL 6990007

FIG.31

COMPARISON OF SYSTEMS

SYSTEM	TYPE 1	TYPE 2	TYPE 3	TYPE 4
	WHOLE TRACK INFORMATION STORING	DEFECT TABLE INFORMATION STORING	DEFECT TABLE INFORMATION STORING	WHOLE TRACK INFORMATION COMPRESSING AND STORING
DEFECTIVE TRACK INFORMATION	ALL TRACKS	---	---	COMPRESSED AND FOR ALL TRACKS
DEFECT TABLE INFORMATION	DEFECTIVE TRACKS ONLY	DEFECTIVE TRACKS ONLY	SEARCHABLE FORWARD AND BACKWARD DEFECTIVE TRACKS	DEFECTIVE TRACKS ONLY
DEFECTIVE TRACK INFORMATION CAPACITY	α	---	---	$\alpha/2^{(R+4)}$
DEFECT TABLE INFORMATION CAPACITY	β	1.1β	1.1β	β
NECESSITY OF PUTTING DEFECT TABLES IN ORDER OF ADDRESS	YES	---	---	YES
NECESSITY OF PUTTING DEFECT TABLES IN ORDER OF ADDRESS	NO	YES	YES	NO
NECESSITY FOR F/W TO KNOW STORAGE ADDRESS	YES	YES	NO	YES
NUMBER OF TIMES OF ACCESSING BUFFER UNTIL REACHING TARGET DEFECT TABLE	2 - 17	$n + 1$	n	$2 - 2^{(R+4)+1}$

(*1) R IS RIGHT SHIFT AMOUNT

(*2) n IS PLACE OF DEFECT IN SEQUENCE OF STORAGE, COUNTING FROM THE SMALLEST ADDRESS

(*3) α AND β ARE A CONSTANT FOR COMPARISON OF CAPACITY RATIO (BYTE COUNT) OF EACH TYPE

FIG.32

CONVERSION FROM HOST LOGICAL NUMBER
TO DISK PHYSICAL NUMBER

